

The Finding Efficiency of the Training Set: Controlling Electric Traffic Lights via the IoT System

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Abstract - This research aims to study the efficiency of the training set of programs control on peripheral devices and interruptions by applying the IoT system, and for using in the teaching and learning of embedded system subjects for the graduate technology curriculums, the major of electrical technology and automatic control systems, in the year of 2016 at Siam Technology College. The training set consists of devices kit and document for practice and then used it for conducting an experiment in the 1st semester of the academic year 2018. The sample group of 20 students is the 4th year undergraduate students, major of electrical technology and automatic control systems. The results show that the evaluation in average by the experts are in the range of 4.20-4.44 in each side, which is a good level according to the set criteria. The consistency index between the objectives and the exams (IOC) is 0.9. The percentage of the average score between pre-test and post-test are 80.4 and 82.04, which is higher than the setup criteria at 80/80. In addition, the statistical analysis (t-test) found that the students have higher academic achievement at a significant level of 0.01.

Keywords - Traffic Signals Controlling, IoT System

I. INTRODUCTION

At present, Thailand has entered into the 4.0 era. Microcontroller technology has been developed to have the ability to process data quickly and inexpensive, and also easy to learn and design. Users can write programs in a simple C language [1], as well as many supporting tools assisting in system development and design. Human resource development in the field of technology and industry is the key to bring the country progressing into Thailand 4.0. Taking high technology and capability to develop technology from what is available in foreign countries to create new technologies. The quality of the population is an important factor in the development of the country. In the topic of programs control on peripheral devices and interruptions of embedded system subjects [2].

According to graduate technology curriculums, it is found that studying must rely on understanding and practicing skills. For this reason, the researcher is interested in developing the learners by using a training set for creating an experimental set of electrical traffic signals controlling via the IoT system, which helps the learners to gain their knowledge as well as to get better and faster understanding the lesson. Including building up an interest in learning, and also motivating them to get experiences and apply their own knowledge for the real work.

II. OBJECTIVES

1) To create and measure the efficiency of the experimental set of electrical traffic control via the IoT system.

2) To compare the average score of achievement between the pre-test and the post-test.

III. METHODOLOGY

This research is the experimental research which divided into steps as follows:

1. The population and sample groups in this research are divided into 2 groups:

1) The population and sample groups as the experts for evaluating the quality of the experimental set are:

- The population group is those who have experience with knowledge, expertise, and experience in work or teaching in the automatic control system for at least 5 years.

- The sample group is those who have experience with knowledge, expertise, and experience in work or teaching in the automatic control system for not less than 5 years, and 3 samples selected by purposive sampling.

2) The population and sample groups as the learners for evaluating the quality of the experimental set are:

- The population group is the 4th year undergraduate students, major of electrical technology and automatic control systems, Siam Technology College.

- The sample group is the 4th year undergraduate students, major of electrical technology and automatic control systems, Siam Technology College, and 20 samples selected by purposive sampling.

2. The research tools in this study consist of training kit, documentation, and testing forms which details of the building process are:

1) Course analysis, in order to know the scope of the content of the embedded system course, re peripheral device controls and interruptions, details are as follows:

- To scope and study the course contents of the embedded systems, course code: 242-426, re peripheral device controls and interruptions, department of electrical technology and automatic control systems, in the year of 2016.

- To analyze the course contents by collecting information from teaching materials and various texts on peripheral device controls and interruptions.

- To analyze knowledge by dividing the knowledge into 3 levels of intellectual abilities: recalled knowledge, applied knowledge, and transferred knowledge.

- To define the behavioral objectives by defining the characteristics of knowledge and skills in order to obtain the desired behavior of the learners after teaching.

- To determine the teaching and learning activities which are related to the specified behavioral objectives.

- To design the training set in a part of the hardware that can support various activities for the learners to achieve the specified behavioral objectives.

2) Building a training set, re peripheral device controls and interruptions in fig. 1. That is based on the use of PLC [3, 3, 3], but converted into a micro-caller set ESP8266.



Fig. 1 Experimental Set of Electrical Traffic Signals Controlled

3) Writing a document of experiment sets such as instructor handbook and student handbook, details are as follows:

- The instructor handbook contains guidelines for using the training sets, performance evaluation, content sheets, answer sheets, exercises, post-test, test solution, and performance evaluation sheet.
- The student handbook contains the content sheets and exercises.

4) Creating a quality assessment form of the training set by the expert's opinion. The evaluation of the quality of the training set consists of 4 aspects: contents, training sheets, training set, and test forms that characterize the questions for quality assessment, and divided into 2 parts: (1) the five rating scales questions and (2) the open-ended questions for the expert's additional suggestions.

5) Creating a learning achievement test that contains 2 tests: pre-test and post-test, using the same set of tests with a multiple choice of 4 options for 30 test items.

6) Creating a model for the consistency of the test with behavioral objectives. The evaluation form is a multiple choice of 3 options.

3. Conducting the experiments and collecting the data which is divided into 4 parts: 1) assessment of the quality of the training set by experts, 2) assessment of the consistency

of tests with behavioral objectives, 3) evaluation of the effectiveness of training sets, and 4) assessment of learning achievement.

1) The processes of the quality evaluation for the training set by experts are as follows:

- The researchers contact and issue a letter for an appointment the experts according to the criteria specified by the faculty of technology and set up the date for assessment.
- The researchers advise how to use the quality assessment form of the training kit to the experts.
- The researchers demonstrate and advise how to use the training set that is created for the experts.
- The experts evaluate and give comments.

2) The processes of evaluation on the consistency of the test forms toward behavioral objectives are:

- The researchers submit the assessment form for the consistency of the test with behavioral objectives for each expert, and also make an appointment for receiving the assessment form.
- The researchers collect the data from the assessment form to summarize and use it for correction based on the opinions of the experts.

3) The processes of the evaluation of the effectiveness of the training set are:

- The researchers take the training set for the experiment by teaching to the sample group. After teaching in each topic, all students do the exercises. When all the exercises finished, then calculate the percentage of the total score of the exercises.

- After all students have learned the course, they do the post-test and then the results are calculated to find the percentage of the total score of the test.

- Analyzing the performance of the training set from the results of the exercises and the post-test.

4. The data analysis is divided into 4 parts: 1) quality of the training set analysis, 2) consistency analysis of the tests toward behavioral objectives, 3) analysis of the performance of the test set, and 4) learning achievement analysis, details as follows:

1) The quality of the training set analysis by the experts' opinion taking from the evaluation results in which the 5 levels of the rating scales of the questionnaires are calculated for the average value of each part.

2) The consistency analysis of the tests toward on the behavioral objectives taking from the evaluation forms of 3 choices such as +1, 0, and -1 for calculating the IOC.

3) The analysis of the performance of the test set taken from the percentage of the average scores of during classes and after

classes and then comparing with the criteria set at 80/80.

4) The learning achievement analysis taking from the results of the pre-test and the post-test to analyze the learning achievement using the t-test. A significant difference was found between the average of the test scores before and after study at the statistical level of 0.01.

IV. RESULTS

1) The result of the quality analysis of the training set by the experts' opinion consists of 4 aspects: content, worksheet, the training set, and testing forms. The total of 20 assessment topics was used, and when considered in each area, it found that the average content of the program is 4.44. The average score of the experimental set is 4.40. The average training set is 4.20 and the test average is 4.28. Based on the evaluation of all 4 aspects, it was found that the average score was between 4.20-4.44, which was at a good level as shown in fig. 2.

2) The results of the consistency analysis of the test toward on the behavioral objectives by the experts' opinion found that all 20 test items had the consistency value of 0.67-1.00 with the average of 0.9 which was higher than the criteria set at 0.5.

3) The results of the performance analysis of the test set showed that the test set efficiency was 80.4 / 82.04 which was higher than the criteria set at 80/80 as shown in table I.

**TABLE I
THE PERFORMANCE ANALYSIS OF THE TEST SET RESULTS**

Items	N	ΣX	Full Score	\bar{x}	Percentage
Exercise Scores	20	804.01	50	40.2	80.4
Testing Scores	20	492.22	30	24.61	82.04

Table I, shows that the sample group of 20 students did the exercises correctly at 80.4 % of the total exercise scores and did the post-

test correctly at 82.04%.

4) The results of the learning achievement analysis found that learners had higher

learning achievement by analyzing the statistical t-test at a significant level of 0.01 as shown in table II.

TABLE II
THE LEARNING ACHIEVEMENT ANALYSIS RESULTS

Items	N	\bar{x}	ΣD	ΣD^2	t
Pre-test Scores	20	18.60	351	123,201	19.02*
Post-test Scores	20	36.15			

Table II, shows that the results of the test between the average test scores of before and after learning were higher than the value of 2.6245. Indicating that the pre-test and the post-test scores were different on average after the study, which was higher than before learning at the statistical significance level of 0.01.

V. CONCLUSION

The efficiency of the training set of programs control on peripheral devices and interruptions by applying the IoT system, and for using in the teaching and learning of embedded system subjects for the graduate technology curriculums, the major of electrical technology and automatic control systems, in the year of 2016 at Siam Technology College. The training set consists of devices kit and document for practice and then used it for conducting an experiment in the 1st semester of the academic year 2018. The sample group of 20 students is the 4th year undergraduate students, major of electrical technology and automatic control systems. The results show that the evaluation in average by the experts are in the range of 4.20-4.44 in each side, which is a good level according to the set criteria. The consistency index between the objectives and the exams (IOC) is 0.9. The percentage of the average score between pre-test and post-test are 80.4 and 82.04, which is higher than the setup criteria at 80/80. In addition, the statistical analysis (t-test) found that the students have higher academic achievement at a significant level of 0.01.

VI. SUGGESTION

In order to gain knowledge and understanding how to control electrical traffic signals via the IoT system, students should practice building the circuits by themselves. As a result, they could gain more understanding of the operation of devices.

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(Arranged in the order of citation in the same fashion as the case of Footnotes.)

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